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DIVISION 33 - UTILITIES

SECTION 33 56 18.00 20

REPAIR OF FUEL STORAGE TANKS

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Repair of a Red Hill fuel storage tank.

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SECTION 33 56 18.00 20

REPAIR OF FUEL STORAGE TANKS
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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325	(2011) Steel Construction Manual

AMERICAN PETROLEUM INSTITUTE (API)

API MPMS 2.2D	(2003; R 2009) Manual of Petroleum Measurement Standards Chapter 2: Tank Calibration - Section 2D: Calibration of Upright Cylindrical Tanks Using the Internal Electro-Optical Distance Ranging Method
API RP 1110	(2013) Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide
API RP 2207	(2007; R 2012; 6th Ed) Preparing Tank Bottoms for Hot Work
API RP 575	(2014; 3rd Ed) Inspection Practices for Atmospheric and Low-Pressure Storage Tanks
API RP 578	(2010; 2nd Ed) Material Verification Program for New and Existing Alloy Piping Systems
API RP 621	(2010; 3rd Ed) Reconditioning of Metallic Gate, Globe, and Check Valves
API Spec 6D	(2014; Errata 1-2 2014; Errata 3-5 2015; ADD 1 2015) Specification for Pipeline Valves
API Spec 6FA	(1999; R 2006; Errata 2006; Errata 2008; R 2011) Specification for Fire Test for Valves
API Std 2015	(2014) Safe Entry and Cleaning of Petroleum Storage Tanks
API Std 598	(2009) Valve Inspecting and Testing

API Std 650	(2013; Errata 1 2013; Addendum 1 2014; Errata 2 2014; Addendum 2 2016) Welded Tanks for Oil Storage
API Std 653	(2014) Tank Inspection, Repair, Alteration, and Reconstruction

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2016) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-105-2006)

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 10-15	(2015) Design of Latticed Steel Transmission Structures
ASCE 37-14	(2015) Design Loads on Structures During Construction
ASCE 7	(2010; Errata 2011; Supp 1 2013) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.1/A5.1M	(2012) Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS A5.10/A5.10M	(2012) Welding Consumables - Wire Electrodes, Wires and Rods for Welding of Aluminum and Aluminum-Alloys - Classification
AWS A5.18/A5.18M	(2005) Carbon Steel Filler Metals for Gas Shielded Arc Welding
AWS A5.22/A5.22M	(2012) Specification for Stainless Steel Flux Cored and Metal Cored Welding Electrodes and Rods
AWS A5.3/A5.3M	(1999; R 2007) Specification for Aluminum and Aluminum-Alloy Electrodes for Shielded Metal Arc Welding
AWS A5.32/A5.32M	(2011) Specification for Welding Shielding Gases
AWS A5.4/A5.4M	(2012) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS A5.9/A5.9M	(2012) Specification for Bare Stainless Steel Welding Electrodes and Rods
AWS D1.1/D1.1M	(2015) Structural Welding Code - Steel

AWS D10.7/D10.7M	(2008) Guide for the Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe
AWS QC1	(2007) Standard for AWS Certification of Welding Inspectors
AWS WHB-4.8	(1998) Welding Handbook, Volume 4 - Materials and Applications Part 2
AWS Z49.1	(2012) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME B1.1	(2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B16.11	(2011) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
ASME B16.48	(2015) Line Blanks
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2012) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(2012; Errata 2013) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.3	(2014) Process Piping
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC II-A	(2015) BPVC Section II-Materials-Part A-Ferrous Materials Specifications
ASME BPVC SEC IX	(2015) BPVC Section IX-Welding and Brazing Qualifications
ASME BPVC SEC V	(2015) BPVC Section V-Nondestructive Examination

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2014) Standard Specification for Carbon

	Steel Forgings for Piping Applications
ASTM A182/A182M	(2016) Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193/A193M	(2016) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2016) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A216/A216M	(2016) Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
ASTM A234/A234M	(2013; E 2014) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A36/A36M	(2014) Standard Specification for Carbon Structural Steel
ASTM A500/A500M	(2013) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2014) Standard Specification for Ductile Iron Castings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A743/A743M	(2013a; E 2014) Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
ASTM A992/A992M	(2011) Standard Specification for Structural Steel Shapes
ASTM B247	(2009) Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings

ASTM C144	(2011) Standard Specification for Aggregate for Masonry Mortar
ASTM E1316-14	(2014) Standard Terminology for Nondestructive Examinations
ASTM E1621-13	(2013) Standard Guide for Elemental Analysis by Wavelength Dispersive X-Ray Fluorescence Spectrometry
ASTM E329	(2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E415-15	(2015) Standard Test Method for Analysis of Carbon and Low-Alloy Steel by Spark Atomic Emission Spectrometry
ASTM E94	(2004; R 2010) Radiographic Examination
ASTM F3125-15a	(2015) Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength
ASTM F436	(2011) Hardened Steel Washers

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 9001	(2008; Corr 1 2009) Quality Management Systems- Requirements

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 306	(2014) Standard for Control of Gas Hazards on Vessels

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC S348	(2009) RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE AMS3275	(2009; Rev C) Sheet, Acrylonitrile Butadiene (NBR) Rubber and Non-Asbestos Fiber Fuel and Oil Resistant

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

FC 1-300-09N	(2014) Navy and Marine Corps Design Procedures

MIL-PRF-907	(2004; Rev F) Antiseize Thread Compound, High Temperature
STANDARD DESIGN AW78-24-27	(2015) Aboveground Vertical Steel Fuel Tanks With Fixed Roofs
UFC 3-301-01	(2013; Change 1) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.23	Guarding Floor and Wall Openings and Holes
29 CFR 1926.1400	Cranes and Derricks in Construction
49 CFR 195	Transportation of Hazardous Liquids by Pipeline

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC P-307	(2009) Management of Weight Handling Equipment

U.S. NAVAL SEA SYSTEMS COMMAND (NAVSEA)

NAVSEA T9074-AS-GIB-010/271	(2014; Revision 1) Requirements for Nondestructive Testing Methods

U.S. NAVAL SUPPLY SYSTEMS COMMAND (NAVSUP)

NAVSUPGLSINST 10345.1	(2015) Fuel Tank Return to Service

1.2 DEFINITIONS

1.2.1 Barrel

As used in this Section, volume unit of product comprised of 42 US gallons.

1.2.2 Designer of Record

The professional engineer nominated by the prime contractor to be in responsible charge of all storage tank design and repair.

1.2.3 Gas Test Hole

Hole installed through the tank shell for purposes of determining the presence of hydrocarbon vapors, compliance with Marine Chemist requirements to certify a space to be gas-free, or inerting a space.

1.2.4 Hazardous Area

As used in this Section, any area within 100 feet of active storage tanks, areas within 100 feet of leaking sections of fuel pipelines or other vapor sources, areas within 200 feet of the downwind side of potential vapor emission sources (i.e., pressure-vacuum vents, sample ports, or open vents on active tanks; leaking sections of pipelines), areas within existing tanks, and areas within a tunnel or adit.

1.2.5 Hot Work

As used in this Section, includes: drilling, boring, flame heating, welding, torch cutting, brazing, carbon arc gouging, grinding, abrasive blasting, or any work which produces heat, by any means, of 400 degrees F or more; or in the presence of flammables or flammable atmospheres, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, nonexplosion-proof lights, fixtures, motors or equipment.

1.2.6 Independent

Impartial third party not a part or affiliated with Contractor or subcontractor principal or subsidiary businesses.

1.2.7 Marine Chemist

The holder of a valid Certificate issued by the National Fire Protection Association in accordance with the "Rules for Certification of Marine Chemists", pursuant to NFPA 306, establishing the individual as qualified to determine whether construction, alteration, repair, or shipbreaking of vessels can be undertaken with safety.

1.2.8 Seal Weld

Weld required to maintain hydraulic integrity and compliant with acceptance criteria for porosity in ASME B31.3.

1.2.9 Snug-Tight Condition

Tightness attained by either a few impacts of an impact wrench or the full effort of a worker with an ordinary spud wrench that brings the plies into firm contact in accordance with RCSC S348.

1.2.10 Tank Engineer

One or more licensed professional engineers, or an engineering firm, acceptable to the Contracting Officer who are knowledgeable and experienced in the engineering disciplines associated with evaluating mechanical and material characteristics that affect the integrity and reliability of fuel storage tanks. The storage tank engineer is the tank repair subject matter expert.

1.2.11 Tank Inspector of Record

The individual, certified as a fuel storage tank inspector, in responsible charge of the storage tank inspection who will sign the suitability for service letter. The recognized certification is API Std 653.

1.2.12 Turn-of-Nut Pretensioning

Method of achieving specified pretension by rotating the nut or bolt of a fastener assembly a specific turn angle in accordance with RCSC S348.

1.2.13 Weld Map

Drawing(s) containing sketches and tables which correlate design, weld plan, shop drawings, and nondestructive examination (NDE).

1.2.14 Welding Personnel

As used in this Section, individuals performing welding to include welder, welding operator, and tack welder.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

NDE Plan; G

Test Water Disposal Plan; G

Weld Plan; G

Welding Procedure Specification; G

Welder Performance Qualification; G

Ventilation Plan; G

Tank Plate Access Plan; G

SD-02 Shop Drawings

Tower, Bridge, and Catwalk; G

Grout Nozzles And Strain Gauge Pipe; G

Weld Map

Interior Piping And Supports; G

Sample Lines; G

Drain Line; G

Nozzles, Flanges, And Manway; G

Tank Appurtenances And Attachments; G

Weld Repair; G

Fillet Welded Patch Plate; G

Insert Plate; G

Weld Tracking Log; G

Gas Test Hole Repair; G

SD-03 Product Data

Ball Valve; G

Double Block And Bleed Ball Valve; G

Anti-Seize Compound

Plug Valve (Double Block And Bleed Type); G

SD-05 Design Data

Repair Log; G

Design Documents; G

SD-06 Test Reports

Test Water Characterization; G

Hydrostatic Test Record; G

Impact Test Data

Mill Test Reports

DBB Valve Hydrotest Report

Base Metal Data; G

Procedure Qualification Record; G

Weldability Procedure Qualification Record; G

SD-07 Certificates

Marine Chemist Certificate

Independent Testing Organization; G

Independent Tank Inspector; G

Nondestructive Examiner Certification; G

Welding Inspector Certification; G

Instrument Calibration Certificate

Tank Inspector of Record; G

SD-09 Manufacturer's Field Reports

Valve Reconditioning Report; G

Audit Inspection Findings; G

SD-11 Closeout Submittals

Completion Report; G

Post-Repair Inspection Report; G

Tank Calibration Table; G

Electronic Tank Calibration Table; G

1.4 GENERAL REQUIREMENTS

Design, materials, repair, fabrication, appurtenances, welding, testing and examination shall be in accordance with API Std 653, ASME B31.3, AWS D1.1/D1.1M, and as indicated and specified herein. The basis for tank repairs and alterations shall be API Std 650 equivalence. The basis for nozzle and piping repairs and alterations shall be ASME B31.3 equivalence.

1.4.1 Welding

This Section covers welding on storage tanks and associated piping. Contractor is responsible for the quality of design, joint preparation, welding, inspection, and examination.

Deviations from applicable codes, approved procedures, and approved detail drawings are not permitted without prior written approval by the Contracting Officer. Materials or components with welds made offsite will not be accepted if the welding does not conform to the requirements of this Section. Develop procedures for welding all metal included in the work. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved.

Welding shall not start until welding procedures, inspectors, NDE personnel, and welding personnel have been qualified and approved. Procedure and performance qualification testing shall be performed by an approved testing laboratory. Notify the Contracting Officer at least 1 week in advance of the time and place of the tests. If the Contracting Officer elects to witness, the qualification tests shall be performed at or near the worksite.

Maintain current records of test results obtained in the welding procedure and welding personnel performance qualifications. Maintain NDE procedures readily available at the site for review by the Contracting Officer. Procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses shall be qualified. Unless specified herein, the choice of welding process shall be the responsibility of the Contractor.

In-service welding is prohibited without specific approval from the Contracting Officer.

All materials used in the welding operations shall be clearly identified and recorded. The inspection and testing defined in this section are minimum requirements. Additional inspection and testing shall be the responsibility of the Contractor when it is necessary to achieve the quality required.

1.4.2 Weld Inspection

This Section contains requirements to inspect all welding. Ensure compliance with all requests of the Weld Inspector(s) to correct deficiencies in materials and workmanship. Correct all deficiencies in

materials and workmanship in compliance with the requirements of this Section.

1.4.3 Nondestructive Examination

This Section covers requirements for conducting NDE used to determine the presence of surface and subsurface discontinuities in metals. Nondestructive methods are also required to weld the weld design to material conditions inside the tank. This Section provides minimum requirements to qualify personnel, procedures, and equipment, and contains acceptance criteria.

1.5 ADMINISTRATIVE REQUIREMENTS

1.5.1 Sequencing

Conduct tank inspection in accordance with Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS. Inspect and validate predictive repairs during the design phase in accordance with Section 01 14 0.05 20. Use the results of the inspection and validation to inform the design in accordance with paragraph DESIGN REQUIREMENTS. Do not finalize the design until inspection results have been analyzed, reported to the Government, and concurrence has been received as to the extent of repairs.

Repair work shall be authorized by the Tank Inspector and the Designer of Record before commencement of work by a repair organization. The Tank Inspector will designate inspection hold points which are required during the repair sequence. The Tank Inspector shall approve all repair and alteration work at the designated hold points.

1.5.2 Scheduling

Do not start tank repairs until the design has been issued for construction and the Contracting Officer has accepted the design. Do not start coating repairs until tank repairs affected by the coating installation have been completed, inspected and accepted by the Government.

1.5.3 Pre-Repair Meetings

Conduct onsite meetings prior to and during the execution of repair work pursuant to Section 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL, and as follows.

a. Prior to the start of each unique type of repair

b. Prior to restart of work following a shutdown

c. Upon any change in personnel of Superintendent, Quality Control Manager, or Site Safety and Health Officer (SSHO)

d. Minimum once per month during a continuous repair evolution

The Quality Control Manager (QCM) shall chair the meetings, extend meeting invitations, publish the agendas, and publish minutes. Notify the Contracting Officer 14 work days prior to each meeting. Minimum required attendance is the foreman for personnel conducting repairs, SSHO, Superintendent, and operators of any equipment providing tank shell access for workers. If the API inspector or tank engineer is onsite, attendance is required.

Meeting content shall comply with paragraph QUALITY ASSURANCE. Distribute meeting minutes to all attendees and the Contracting Officer within three calendar days of the meeting.

1.6 DESIGN REQUIREMENTS

Consult with expe[redacted] experienced in Red Hill tank inspection and repair. Provide subject matter professional engineering expertise to design tank repairs. Design all repairs. Validate storage tank conditions as-needed during the design phase to fully inform a complete design. Produce professional design drawings, sketches, shop drawings, and specifications which are complete, usable, and compliant with FC 1-300-09N.

Use contents of pedigree report performed in Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS and positive material identification (PMI) performed pursuant to this Section to inform the weld design.

Analyze results of the inspection and structural analysis of the lattice tower, bridge, and catwalk performed in Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS. Analyze construction loading on the tower, bridge, and catwalk. Use results of these analyses to inform the structural repair design of the lattice tower, bridge, and catwalk.

Provide design drawings and specifications. Submit Design Documents pursuant to Section 01 33 10.05 20 DESIGN SUBMITTAL PROCEDURES.

1.6.1 Drawi[redacted]

Design drawings shall be to scale. Depict all areas of the tank. Minimum drawing set shall consist of the following.

a. Title sheet and drawing index

b. Structural notes

c. Floor plan

d. Lower dome plan

e. Shell rollout elevation

f. Upper dome and cover channel reflected plan

g. Nozzle piping plan

h. Interior piping plan

i. Piping details

j. Tower, bridge, and catwalk details

k. Repair details

l. Existing features such as telltale patch plates, grout nozzles, strain gauge plugs

m. Adjustment plate and expansion joint details

1.6.2 Repair Standards

1.6.2.1 General

Geometry, configuration, and structural shapes exist in the tank which could require repairs not fully compliant with API Std 653. Design repairs to comply with API Std 653 to the fullest extent possible. Minimize welding in the original construction heat affected zone. Deploy larger patch plates which span adjacent repair sites and original construction welds in order avoid encroachment into minimum weld toe spacing requirements of API Std 653. Fillet welded patch plates shall overlap butt-joint welded vertical or horizontal shell seams a minimum of 6 inches beyond the shell seam. Identify locations where minimum spacing requirements cannot be met. Verify with light grinding and NDE all arc strikes are not crack initiation sites.

Coordinate the location of lapped patch and insert plates with existing tank joints. Make all necessary adjustments to meet joint spacing requirements.

1.6.2.2 Tower, Bridge, and Catwalk

Design repairs to the lattice tower, bridge, and catwalk structure to restore missing structural components or capacity, and address damage and defects. Provide guides to restrain the tower columns at the upper dome. Provide bracing and supports to resist all construction loading conditions and provide compliance with with ASCE 37-14. Follow design standards ASCE 10-15 and AISC 325. Use load requirements in accordance with ASCE 7 and ASCE 37-14. Use structural engineering criteria in UFC 3-301-01.

Design repairs to the catwalk guard which raise height and add rails to be compliant with 29 CFR 1910.23. Raise guard height to be no less than 42 inches measured vertically from the adjacent walking surface. Design guards to resist a single point load of 300 pounds applied in any direction at any point on the top rail to produce the maximum load effect on the element being considered, and to transfer this load through the supports to the structure with no deflection of the guard member greater than L/240. Design guards to resist a linear load of 60 pounds per linear foot and in accordance with Section 4.5 of ASCE 7. Guard and intermediate rail design loads shall be in accordance with Section 4.5 of ASCE 7.

1.6.2.3 Butt Joints

Design butt joints to be welded with complete joint penetration and complete fusion. Weld joint design shall be in accordance with API Std 650 Section 5. Use insert joint repair method on all locations of destructive testing. Each butt joint insert plate 12 inches or smaller in any dimension shall be covered by a fillet welded patch plate which overlaps the insert plate and provides no less than 3 inches between the weld edges. Provide the full regime of NDE on the insert plate welds prior to installing the fillet welded patch plate.

1.6.2.4 Fillet Welded Joints

Fillet welded patch plate repairs are an acceptable method of repair. Weld joint design for fillet welded repair joints shall be in accordance with API Std 653 Section 9, including corner radius criteria. Tombstone type repair plates are acceptable adjoining structural shapes, cover plates, and stiffener plates.

1.6.2.5 Grout Nozzle and Strain Gauge Pipe

Remove grout nozzles which protrude through the shell. Design grout nozzle repairs in a manner which corrects deficient conditions, does not create conditions conducive to crevice corrosion, and does not encroach into minimum weld toe spacing requirements of API Std 653.

Remove strain gauge bolts and shell reinforcement. Design repairs which plug the gauge pipe and annular space, and provide a fillet weld patch on the tank shell. Do not encroach into minimum weld toe spacing requirements of API Std 653.

1.6.2.6 Sample Lines

Design piping system to sample from product heights of 20 foot, 60 foot, 120 foot, and 175 foot. Route piping in lower tunnel to sample station. Provide funnel return at the sample station. Provide means for isolation, identification, and integrity testing of piping.

1.6.2.7 Drain Line

Use results of the inspection performed under Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS to inform the design. Provide in-process weld examination pursuant to ASME B31.3 Chapter VI in addition to requirements of this Section for drain piping. Visually inspect the condition of the root pass after cleaning. Examine with PT or MT technique.

1.6.2.8 Nozzles

Use results of the inspection performed under Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS to inform the design. Provide in-process weld examination pursuant to ASME B31.3 Chapter VI in addition to requirements of this Section for nozzle piping. Visually inspect the condition of the root pass after cleaning. Examine with PT or MT technique.

1.6.3 Engineered Plans

1.6.3.1 Tank Plate Access

Design means and methods which provide robust access for personnel, materials, and equipment to all areas of the tank envelope. Design in accordance with ASCE 7, AISC 325, ASCE 37-14, EM 385-1-1, NAVFAC P-307, and 29 CFR 1926.1400. Ensure all construction loading conditions of the lattice tower, bridge, and catwalk including point loads, are addressed in the design. Submit Tank Plate Access Plan in accordance with paragraph SUBMITTALS.

1.6.3.2 Ventilation

Design ventilation and tank entry means and methods which will provide a gas-free environment suitable for safe entry and compliant with API Std 2015. Consider all regions of the storage tank equivalent to a tank bottom and prepare for work in accordance with API RP 2207. Expect liquid or hydrocarbon vapors in the tank shell to substrate interstice. Address environmental conditions of the interstice. Should gas test holes be required, provide an engineered detail to install the holes and purge the interstice with inert gas. Submit Ventilation Plan in accordance with paragraph SUBMITTALS

1.6.3.3 Welding

Utilize PMI in-situ methods to assess the suitability of the base metal in relation to the pedigree report results, findings of the chemical analysis performed pursuant to paragraph DESIGN REQUIREMENTS, and the weld plan.

Address all aspects of welding, inspection, and examination to meet requirements of this Section. Identify methods to minimize heat distortion, sequence of welding, in-situ and offsite welding, and a process for utilizing multiple welders on the same weld. Establish fit-up and edge preparation tolerances. Do not use the FCAW process on tank envelope or seal welds. Use low-hydrogen processes and electrodes on welds to tank shell. Restrict weld processes for root passes to gas tungsten or shielded metal arc. Include in the plan weld specification and qualifying record for each procedure along with a summary table which lists all qualified welding personnel and the WPS under which they are qualified. Submit Weld Plan in accordance with paragraph SUBMITTALS.

1.6.3.3.1 Welding Personnel Identification

Assign each welding personnel a unique identification number, letter, or symbol. Place identification on the weld map. Ensure each identification is traceable to a welder and an associated performance qualification record.

1.6.3.3.2 Symbology

Weld symbology and drawings specifying NDE shall employ symbols accordance with AWS A2.4.

1.6.3.4 Hydrostatic Testing

Provide a Hydrostatic Testing Plan which will establish post-repair tightness of nozzle and containment piping, as well as tightness and strength of drain and sample line piping. Testing shall be in compliance with 49 CFR 195, API RP 1110, and ASME B31.3. Plan will include site specific procedure, fill points, anticipated fill volume, air bleed location, material specification, pressure classification of valves, flanges, fittings, and instruments in each segment. Use fresh water with less than 50 ppm Chloride content as the test medium. Do not use a test pressure which exceeds yield strength. Designate a hydrostatic test examiner who shall be in responsible charge of executing the test plan, examining for leaks, and certifying results. Acceptance criteria are in paragraph HYDROSTATIC TEST PARAMETERS.

1.6.3.5 Nondestructive Examination

Submit an NDE Plan for nondestructive examination and testing. Procedures, personnel, methods, equipment, calibration, examinations, and records shall be compliant with this Section, ASME B31.3, and ASME BPVC SEC V. Examination criteria for piping shall be considered severe cyclic conditions. Conform NDE terminology to ASTM E1316-14.

Perform PMI with in-situ elemental analysis methods such as x-ray fluorescence (XRF) or optical emission spectroscopy (OES) in accordance with API RP 578. Determine through PMI testing whether base metal at a weld site is consistent with the weld plan, pedigree report findings, and chemical analysis.

List individuals and their responsibilities for executing the NDE plan. Include examiner qualifications and certifications. Describe tests and examinations which will be performed. Include requirements for instrument calibration. Detail the process to identify and correct defects. Include written procedures, methods, specifications, and procedure qualifications for all NDE methods. Appropriate nondestructive technologies are listed in paragraph APPROPRIATE NONDESTRUCTIVE TECHNOLOGY.

1.6.3.6 Appropriate Nondestructive Technology

Nondestructive Method	Symbol	Detection Window
Visual inspection	VT	Detection of surface discontinuities by direct viewing using line-of sight vision or enhanced with the use of optical instruments
Ultrasonic testing	UT	Detection of discontinuities throughout the volume of material, measurement of wall thickness, and evaluation of bond characteristics in most types of material and in basic geometric configurations
Liquid penetrant examination	PT	Detecting the presence of surface discontinuities in ferrous and nonferrous materials
Magnetic particle examination, wet suspension	MT	Detection of surface or near surface discontinuities in ferromagnetic materials
Radiologic testing	RT	Detection of discontinuities throughout the volume of welds
Vacuum box testing	VBT	Detection of leaks and through wall defects in the hydraulic boundary
X-ray fluorescence	XRF	Elemental analysis of base metal
Optical emission spectroscopy	OES	Elemental analysis of base metal

1.6.4 Safety

Incorporate safety as an element of the design. Conform to Section 01 35 26.05 20 GOVERNMENT SAFETY REQUIREMENTS FOR DESIGN BUILD, EM 385-1-1, Hot Work Permit, and AWS Z49.1. Design ventilation such that throughout the duration of work, spaces will be maintained in a safe condition.

1.6.4.1 Marine Chemist

Provide the services of a Marine Chemist responsible for certifying all spaces safe for hot work and for specifying precautionary measures required to perform the work.

1.7 QUALITY ASSURANCE

1.7.1 Data Management

Provide a non-proprietary professional data management system to track destructive testing, PMI, repairs, inspection, NDE testing, and established pursuant to Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS. Provide secure, auditable, and organized data. Ensure the system has the capability to easily determine the provenance of each repair.

1.7.1.1 Repair Log

Produce a Repair Log capable of uniquely tracking every repair on the project. Follow the tank location identification scheme established pursuant to Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS. Initial dataset shall be informed by the inspection indication records. Populate repair log with gas test hole locations.

1.7.1.2 Weld Tracking Log

Develop a Weld Tracking Log as a subset of the Repair Log and capable of uniquely identifying and tracking every weld on the project. Follow the tank location identification scheme established pursuant to Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS. The log shall include the following:

a. Location in tank

b. Type of weld including temporary and tack welds

c. Applicable WPS

d. Name or identification number of welding personnel

e. Date and time of completion of welding or tacking

f. Name and date of inspector performing visual inspection

g. Date and type of NDE testing

h. Examiner name and acceptance criteria

i. Description of defects found; reason for non-compliance; corrective action taken

j. Date, time, and inspector who deemed weld acceptable

Weld identification on the shop drawings shall match weld tracking log. Update and populate the log as work progresses, and submit to the Contracting Officer as part of progress documentation and the contract completion report.

1.7.1.3 Base Metal Data

Provide Base Metal Data report containing findings of the pedigree report, chemical analysis, and PMI results. Provide detailed location in the tank of each coupon or test.

1.7.2 Shop Drawings

Prepare all shop drawings using a Registered Professional Engineer or under the direct supervision of a Registered Professional Engineer. Elements of fabricated items inadvertently omitted on design drawings shall be returned to the Designer of Record for detailing, or shall be detailed by the fabricator and so indicated on the shop drawings. Identify all field welds on the shop drawings and distinguish those which are seal welds. Any and all details developed by the fabricator shall be clouded on the shop drawings for separate approval by the Engineer of Record. All design shall

be prepared and sealed by a Registered Professional Engineer.

Correlate location of repairs depicted on the shop drawing to design plan view and elevation drawings. Shop drawings shall depict existing localized conditions to include shell thickness, weld toe spacing dimensions, and adjacent structural shapes. Show the isometric view when needed for clarity. Denote new material specification, grade, size, thickness, dimensions, and fitup tolerances. Identify weld specification, surface preparation standards, proposed weld sequence, and required NDE. Provide shop drawings for the following types of repairs.

1.7.2.1 Insert Plate

Insert plates shall be complete penetration and complete fusion butt joint welds. In addition to visual examination, provide UT in lieu of RT in accordance with API Std 650 Annex U.

Indicate original construction plate arrangement, cut edge locations, and distance to tower,bridge, catwalk, nozzles, flanges, welds, cover plates, and structural shapes. Identify associated fillet welded patch plate if required.

1.7.2.2 Fillet Welded Patch Plate

Indicate original construction plate arrangement, patch plate locations, and distance to tower, bridge, catwalk, nozzles, flanges, welds, cover plates, and structural shapes. Show clearance from original construction welds, insert plate welds, and shell repairs. Drawings shall also indicate details of nozzles, insert plates, welds, and reinforcing plates. Ensure patch plate meet API Std 653 requirements for minimum radius on all corners.

1.7.2.3 Gas Test Hole Repair

Indicate original construction plate arrangement, patch plate locations, and distance to tower, bridge, catwalk, nozzles, flanges, welds, cover plates, and structural shapes. Show clearance from original construction welds, insert plate welds, and shell repairs. Dimension test hole centerline with patch plate edges.

1.7.2.4 Weld Repair

Prior to repair, examine the surface to be repaired with either MT or PT. The area to be repaired shall have coating removed and be suitably prepared for welding in accordance with a written procedure. The area of an individual weld repair shall not exceed 50 square inches. The depth of a weld repair shall not exceed one-third of the base material thickness.

1.7.2.5 Barrel to Lower Dome Joint

Repair excessive corrosion on the stiffener plate with full penetration butt joint welds. Repairs to the stiffener plate and its joints with the shell and dome shall be in accordance with API Std 653 12.1.6.

1.7.2.6 Expansion Joint

Repair excessive corrosion on the expansion joint plates by removal and replacement with full penetration butt joint welds. Ensure repairs to the upper and lower joint plates do not fuse the plates together except at the edge.

Repairs to the expansion ring to barrel and upper dome joints shall be in accordance with API Std 653 Section 12.1.6.

1.7.2.7 Upper Dome and Extension Ring Cover Channels

Repair excessive cover plate corrosion by replacement. Replace leaking seal welds on the cover channels with new welding

1.7.2.8 Grout Nozzles and Strain Gauge Pipe

Submit fabrication drawings of grout nozzle and strain gauge pipe repairs. Indicate materials. Include complete information for the fabrication and erection of the repairs, including the location, type, size, and dimensions of welds. Provide procedure to pack the gauge pipe and annular space with dry pack mortar.

1.7.2.9 Nozzles, Flanges, and Manway

Submit fabrication drawings of nozzle and manway repairs. Indicate materials, size, thickness, location, clearance from welds, details of nozzles and flanges, plates, welds, and reinforcing plates. Include complete information for the fabrication and installation of the repair, including the location, type, and size, and dimension of welds.

1.7.2.10 Drain Line

Submit fabrication drawings of drain line repair. Indicate materials, size, location, heights, and welds. Include complete information for the fabrication and installation.

1.7.2.11 Sample Lines

Submit fabrication drawings of sample line pipe routing, alignment, and supports. Indicate materials, size, location, heights, and welds. Include complete information for the fabrication and installation.

1.7.2.12 Interior Piping and Supports

Submit fabrication drawings of interior piping and support repairs. Indicate materials, size, location, thickness, plates, and welds. Include complete information for the fabrication and erection of the repair, including the location, type, size of bolts and welds, gaskets, pipe sizes and lengths, supports, and connection details.

1.7.2.13 Tank Appurtenances and Attachments

Submit fabrication drawings of existing shell attachments identified for removal and replacement: ladders, stairs, and other tank appurtenances. Indicate materials. Include complete information for fabrication and erection of the repairs, including the location, type, and size of bolts, welds, member sizes and lengths, and connection details.

1.7.2.14 Tower, Bridge, and Catwalk

Submit dimensioned fabrication drawings of tower, bridge, catwalk, guardrail, intermediate rail, toe board, and other tank appurtenance repairs. Indicate welds, member sizes, lengths, and connection details. Provide complete information for the fabrication and erection of the

repair. Include the location, type, size, grade of fasteners, and pretensioning procedure. Detail drawings to provide liquid drainage from components and not create conditions conducive to crevice corrosion.

1.7.2.15 Weld Map

Prepare Weld Map to coordinate the physical layout of the tank, the shop drawings, the weld plan, the NDE plan, and welder identification. Include joint configuration, and weld size and type.

1.7.3 Pre-Repair Meetings

Discuss repair work, quality expectations, acceptance standards, and lines of authority during the pre-repair meetings. The QCM shall provide clear direction to all parties regarding acceptable work output, individuals authorized to inspect and test repairs, and consequences for incompetent, careless, or otherwise objectionable work. Meeting agenda items include:

a. Safety

b. Repair procedures, fitup, weld specifications, welding personnel identification

c. Weld inspection process

d. Non-destructive examination process

e. Acceptance criteria

f. Responsibilities of the parties

g. Acceptable standards of quality

h. Documentation of work

1.7.4 Weld Inspection

Provide weld inspection procedures compliant with API Std 650 and ASME B31.3. The weld inspector(s) is considered a QC Specialist and must report results directly to the QC Manager, as specified in Section 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL.

1.7.5 NDE Procedures

Provide NDE procedures for methods compliant with API Std 653, ASME B31.3 and paragraph NDE PROCEDURE STANDARDS. Provide procedure for any PMI technology not listed.

1.7.5.1 NDE Procedure Standards

Method	Procedure Standard
MFL	ASME BPVC SEC V and API Std 653 Annex G
UT	ASME BPVC SEC V Article 4
UT in lieu of RT	API Std 650 Annex U

Method	Procedure Standard
VBT	API Std 650 8.6
PT	ASME BPVC SEC V Article 6
MT	ASME BPVC SEC V Article 7
RT	ASME BPVC SEC V Article 2
VT	API Std 650 8.5
XRF	ASTM E1621-13
OES	ASTM E415-15

1.7.6 Tank Repair Inspection

Provide inspection of repairs by the tank inspector of record. Provide oversight of repairs by the tank inspector of record and the tank engineer.

1.8 QUALIFICATION AND CERTIFICATION

1.8.1 Previously Qualified Procedures and Personnel

Welding procedures and welding personnel previously qualified by test may be accepted for the work without requalification, provided that all of the following conditions are fulfilled:

a. Copies of the Welding Procedure Specification, the Procedure Qualification Record, and the Welder Performance Qualification record for each procedure to be used are submitted in accordance with paragraph SUBMITTALS.

b. Testing was performed by an independent approved testing laboratory or an approved technical consultant. Copies of the Test Laboratory Accreditation and Technical Consultant Certification are submitted and approved in accordance with paragraph SUBMITTALS.

c. The welding procedures, welders, and welding operators were qualified in accordance with ASME BPVC SEC IX, and base materials, filler materials, electrodes, equipment, and processes conformed to the applicable requirements of this specification.

d. The requirements of paragraph RENEWAL OF QUALIFICATION are met and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of conformance.

e. Each procedure qualified by mechanical test in accordance with ASME BPVC SEC IX QW-200 must contain coupon bend test results.

f. Each welding personnel qualified by mechanical test in accordance with ASME BPVC SEC IX QW-300 must contain coupon bend test results. Welding personnel cannot be qualified by initial production welding.

1.8.2 Welding Procedure Specification (WPS)

Prepare welding procedure specifications which provide direction to the welder and welding operator for making production welds. Use the WPS format QW-482 in ASME BPVC SEC IX. Include procedures for weld repairs. Specify back purge gas requirements and end preparation for butt joint welds to include cleaning, alignment, and root opening tolerances. Specify preheat, interpass temperature control, and postheat treatment of welds. Identify weld procedures uniquely and reference on the Weld Map and shop drawings.

WPS shall be compliant with API Std 650 and ASME BPVC SEC IX requirements. Submit each WPS together with its associated PQR, and in accordance with paragraph SUBMITTALS. Approval of a procedure does not relieve Contractor of the sole responsibility for design and production of acceptable welds.

1.8.3 Procedure Qualification Record (PQR)

Perform tests, qualify all procedures including weld repair, and document the results in detail on procedure qualification records. Qualify each proposed welding procedure. Qualify procedures in compliance with API Std 650, ASME BPVC SEC IX, and this Section. Use the PQR format QW-483 in ASME BPVC SEC IX. Submit each PQR together with its associated WPS, and in accordance with paragraph SUBMITTALS.

In addition to qualifying weld procedures, verify weldability of the existing plate steel by qualifying fillet and butt joint weld procedure(s) on a test coupon obtained in accordance with Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS. Qualify procedure(s) which will be used to repair the tank shell. Qualify in compliance with API Std 650, ASME BPVC SEC IX, and this Section. Use the PQR format QW-483 in ASME BPVC SEC IX. Submit the Weldability Procedure Qualification Record together with associated WPS, and in accordance with paragraph SUBMITTALS.

1.8.4 Welding Personnel Performance

Conduct tests to determine the welding personnel, using qualified procedures, are capable of producing the minimum requirements of an acceptable weldment. Test all welding personnel for each welding process to be used. Tests conducted by a different employer are not acceptable. Test in accordance with API Std 650 and ASME BPVC SEC IX.

1.8.4.1 Welder Performance Qualification (WPQ)

A welder or welding operator may be qualified by volumetric NDE or by bend tests on a test coupon. Qualification by initial production welding is not allowed. Before assigning welding personnel to the work, provide WPQ records which certify the individual is performance-qualified for the procedure in accordance with ASME BPVC SEC IX. The certification shall state the type of welding and positions for which each is qualified, the code and welding procedure specification under which each is qualified, date qualified, and the firm and individual certifying the qualification tests. Use the WPQ format in ASME BPVC SEC IX QW-484A for welders and QW-484B for welding operators. Submit each WPQ in accordance with paragraph SUBMITTALS.

1.8.4.2 Renewal of Qualification

Requalification of welding personnel shall be required under any of the

following conditions:

a. When welding personnel has not used the specific welding procedure for a period of 3 months; the period may be extended to 6 months if the welding personnel has been employed on another welding procedure.

b. When welding personnel has not welded with any procedure during a period of 3 months, all the personal qualifications shall be considered expired, including any extension by virtue of "a" above.

c. There is specific reason to question the individual's ability to make welds which will meet requirements of the specifications.

d. The welding personnel was qualified by an employer, other than those firms performing work under this contract, and a qualification test has not been taken within the preceding 12 months.

e. Renewal of qualification for a specific welding procedure under conditions a, b, and d above, needs to be made on only a single test joint or pipe of a thickness, position, or material required by the welding procedure specification to reestablish the welder's or welding operator's qualification for the previous qualification.

f. Any welding personnel qualified by initial production welding.

1.8.5 Weld Inspector

Welding inspectors shall be qualified in accordance with API Std 650, be a certified welding inspector (CWI) or be a senior certified welding inspector (SCWI) as defined in AWS QC1, and have minimum [5][7] years of experience inspecting storage tank welding or process pipe welding on military or commercial fuel storage tanks or piping. Each inspector shall be a certified to be a CWI or SCWI with ASME BPVC SEC IX endorsement. Provide AWS Certified Welding Inspector Certification in accordance with paragraph SUBMITTALS. Provide one SCWI in responsible charge of weld inspection duties to oversee CWI inspection and review all weld inspection reports. The SCWI shall be onsite no less than 25 percent of the time inspection is performed. The weld inspector(s) is considered a QC Specialist in accordance with paragraph WELD INSPECTION.

Should a weld inspector also be a welder, that individual is disqualified from inspecting or examining a weld or any portion thereof of the inspector's own work. All inspectors shall be independent and shall not represent nor be an employee of the prime construction contractor, welding subcontractor, fabricator, erector, or manufacturer. In addition inspectors shall have five years verifiable experience inspecting process pipe welds on military or commercial fuel storage tanks or piping or petroleum refineries.

1.8.6 NDE Examiner

NDE personnel shall be qualified in accordance with API Std 653 and API Std 650. Examiners shall meet minimum requirements for qualification in ANSI/ASNT CP-189. Examiners shall meet minimum requirements for certification in ANSI/ASNT CP-189 and shall be certified in accordance with paragraph NDE EXAMINER QUALIFICATION STANDARDS at minimum to Level II in the applicable NDE method. Provide Nondestructive Examiner Certification in accordance with paragraph SUBMITTALS.

Should an NDE examiner also be a welder, that individual is disqualified from inspecting or examining a weld or any portion thereof of the examiner's own work. Personnel performing NDE examination shall not represent nor be an employee of the prime construction contractor, welding subcontractor, fabricator, erector, or manufacturer. NDE examiners shall have a minimum of five years verifiable experience inspecting similar work. In addition inspectors shall have five years verifiable experience inspecting process pipe welds on military or commercial fuel storage tanks or piping or petroleum refineries.

1.8.6.1 NDE Examiner Qualification Standards

Method	Examiner Qualification Standard
MFL	API Std 653 Annex G
UT	Level II or III
UT in lieu of RT	API Std 650 Annex U with Level III review
VBT	Level II or III
PT	Level II or III
MT	Level II or III
RT	Level III
VT	AWS QC1 CWI and SCWI
XRF	API RP 578

1.8.7 Tank Engineer

Provide licensed professional engineer services with minimum qualifications of each individual:

a. Bachelor of Science degree in Civil or Mechanical Engineering

b. Seven years of experience in POL facilities engineering, including design, inspection, testing and construction.

1.8.8 Tank Inspector of Record

Provide the services of an experienced API Std 653 Inspector who shall have a minimum of seven years of experience. Submit copy of current Tank Inspector of Record certification in accordance with paragraph SUBMITTALS.

1.8.9 Independent Tank Inspector

Provide the services of an independent API Std 653 Inspector who shall have a minimum of five years of experience. Submit copy of current Independent Tank Inspector certification in accordance with paragraph SUBMITTALS.

1.8.10 Independent Testing Organization

The independent testing organization, testing laboratory, technical

consultant or NDE testing firm shall meet requirements of ASTM E329. The principal business of the testing organization, testing laboratory, technical consultant or NDE testing firm shall be inspection and testing, and shall have no involvement in design, procurement, fabrication, construction and installation. The testing organization, testing laboratory, technical consultant or NDE testing firm shall be a first tier subcontractor. Submit copy of current Independent Testing Organization certification in accordance with paragraph SUBMITTALS.

1.8.11 Marine Chemist

Submit copy of current Marine Chemist Certificate issued by the National Fire Protection Association in accordance with the Rules for Certification of Marine Chemists, pursuant to NFPA 306, and in accordance with paragraph SUBMITTALS.

1.9 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with manufacturer recommendations and as approved by the Contracting Officer. Replace damaged or defective items.

Deliver all filler metals, electrodes, and other welding materials to the site in original manufacturer containers. Store in a dry space protected from weather and contamination until used. Containers shall be properly labeled and designed to give maximum protection from moisture and to insure safe handling.

1.9.1 Material Control

Store materials in a controlled access and clean, dry area that is weathertight and is maintained at a temperature recommended by the manufacturer. Materials shall not be in contact with the floor and shall be stored on wooden pallets or cribbing. Cap all piping and valves to prevent contamination by dirt and other foreign material.

1.9.1.1 Damaged Containers

Low-hydrogen steel electrodes shall be stored in their sealed shipping container. If the seal is damaged during shipment or storage, and the damage is not immediately detected, the covered electrodes in that container shall be rebaked in accordance with manufacturer instructions prior to issuance, or shall be discarded. If a container is damaged in storage and the damage is witnessed, the electrodes from that container shall be immediately placed in a storage oven. The storage oven temperature shall be as recommended by the manufacturer or the welding material specification.

1.9.1.2 Partial Issues

When a container of covered electrodes is opened and only a portion of the content is issued, the remaining portion shall, within the limits established by AWS D1.1/D1.1M be placed in a storage oven.

1.9.1.3 Damaged Materials

Materials which are damaged shall be discarded. Covered electrodes which are oil or water-soaked, dirty, or on which the flux has separated from the wire shall be discarded.

PART 2 PRODUCTS

2.1 MATERIALS

Internal parts and components of equipment, piping, piping components, and valves that could be exposed to fuel during system operation shall not be constructed of zinc coated (galvanized) metal, brass, bronze, or other copper bearing alloys. Do not install cast iron bodied valves in piping systems that could be exposed to fuel during system operation.

2.1.1 Steel Plates

Plate material shall be manufactured by the open-hearth, electric-furnace, or basic oxygen process. Meet requirements of API Std 650, Group II, as-rolled, killed or semi-killed, and conforming to ASTM A36/A36M. Provide Mill Test Reports. Provide Impact Test Data when required by API Std 650 for the material group and thickness.

2.1.2 Gaskets

Gaskets shall be composition ring, one piece factory cut, compliant with ASME B16.21, Buna-N. Gaskets shall be composed of either graphite or synthetic fibers in a nitrile binder and shall be resistant to the effects of aviation hydrocarbon fuels and manufactured of fire-resistant materials. Use Full-face gaskets for flat-face flanged joints. Use ring gaskets on raised-face flanged joints. Buna-N material shall conform to SAE AMS3275.

2.1.3 Fasteners

2.1.3.1 Flange Bolts, Nuts, and Washers

Bolts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.1. Bolts shall be of sufficient length to obtain full bearing on the nuts and shall project no more than three full threads beyond the nuts with the bolts tightened to the required torque. Bolts shall be regular hexagonal bolts conforming to ASME B18.2.1 with material conforming to ASTM A193/A193M, Class 2, Grade B8, stainless steel, when connections are made where a stainless steel flange is involved, and Grade B7 when only carbon steel flanges are involved. Bolts shall be threaded in accordance with ASME B1.1, Class 2A fit, Coarse Thread Series, for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch.

Nuts for pipe flanges, flanged fittings, valves and accessories shall conform to ASME B18.2.2, hexagonal, heavy series with material conforming to ASTM A194/A194M, Grade 8, stainless steel for stainless steel bolts, and Grade 7 for carbon steel bolts. Nuts shall be threaded in accordance with ASME B1.1, Class 2B fit, Coarse Thread Series for sizes one inch and smaller and Eight-Pitch Thread Series for sizes larger than one inch.

Washers under bolt heads and nuts shall conform to ASTM F436, flat circular stainless steel for stainless steel bolts, and carbon steel for carbon steel bolts. Use calibrated torque wrenches to tighten all flange bolts to the torque recommended by the gasket manufacturer. Tightening pattern shall be as recommended by the gasket manufacturer.

2.1.3.2 Structural Bolts, Nuts, and Washers

a. Bolts: ASTM F3125-15a (ASTM A325), Type 1, heavy hex style, plain finish. Ensure bolt heads are distinctively marked with the manufacturer unique identifier and grade. Bearing type connections are Type N unless determined otherwise.

b. Nuts: ASTM A563, Grade C, heavy hex style, plain finish. Ensure nuts are distinctively marked with the manufacturer's unique identifier and grade.

c. Washers: ASTM F436, Type 1, circular. When the outer face of the joint has a slope greater than 1:20 with respect to a plane normal to the bolt axis, use ASTM F436, Type 1, beveled to compensate for the lack of parallelism.

2.1.3.3 Thread Lubricant

Provide thread lubricant on fastener to minimize galling compliant with MIL-PRF-907 Anti-Seize Compound on fasteners external to the tank. On tank interior fasteners use SAE 30 oil.

2.1.4 Carbon Steel Pipe

a. Pipe: ASTM A53/A53M, black steel, Type S, Grade B, standard mill finish. For pipe diameters 2 inch NPS or less, use Schedule 80.

b. Butt-Joint Fittings: End connections for pipe or fittings 2-1/2 inch NPS and larger shall be buttweld type conforming to ASTM A234/A234M Grade WPB, and ASME B16.9 Class 150. Backing rings shall conform to ASME B31.3 and be compatible with materials being welded.

c. Forged Fittings (Socket-Welded): End connections for pipe or fittings smaller than 2-1/2 inch NPS shall be forged, socket weld type conforming to ASTM A182/A182M and ASME B16.11 Class 3000.

d. Meet the chemical, physical, and toughness requirements of API Std 650. Submit certificates and certified mill pipe test reports demonstrating compliance with the requirements of API Std 650.

e. When required by API Std 650, submit Charpy V-notch impact test results demonstrating compliance with API Std 650.

2.1.5 Structural Steel Shapes

a. W-Shapes: ASTM A992/A992M, standard mill finish

b. Angles, Channels, and Plates: ASTM A36/A36M, standard mill finish

c. Steel Pipe: ASTM A53/A53M, standard mill finish, Grade B, Type E or S, or ASTM A500/A500M, Grade B

2.1.6 Aluminum Piping For Stilling Wells

Aluminum pipe shall be ASTM B241/B241M, alloy 6061-T6, Schedule 40 for pipe sizes 2 inches through 12 inches; Schedule 80 for pipe sizes 2 inches and smaller. Process per ASME B31.3, GTAW, consumables per AWS A5.10.

2.1.7 Flanges

Provide ASTM A105/A105M Class 150, raised face, weld-neck flange compliant with ASME B16.5.

2.1.8 Bolting And Aluminum Flanges For Stilling Wells

Aluminum flanges shall be ASME B16.5, Class 150 Flat Face Type, except aluminum shall conform to ASTM B247, alloy 6061-T6 or alloy 356-T6. Aluminum flanges may be welding neck or slip-on type. Provide bolting in accordance with paragraph FLANGE BOLTS, NUTS, AND WASHERS. Provide electrical isolation for separation of dissimilar metals.

2.1.9 Valves

Provide valves that meet the material, fabrication and operating requirements of ASME B31.3, except as modified herein. Valves shall have flanged end connections and conform to ASME B16.34, Class 150 except as modified herein. Provide stainless steel stem and trim for each valve. Valves shall have a weatherproof housing. Seats, body seals, and stem seals shall be fluoropolymer elastomer or Buna-N. Do not use threaded or socket welded valves.

a. Valves Connected to Stainless Steel, Aluminum, or Internally Coated Carbon Steel Piping. Provide valves with bodies, bonnets, and covers constructed of stainless steel conforming to ASTM A743/A743M, Type 304 or 316; or cast steel conforming to ASTM A216/A216M, Grade WCB internally plated with nickel or internally electroless nickel plated; or ductile iron conforming ASTM A536, electroless nickel plated.

b. Valves Connected to Carbon Steel Piping (No Internal Coating). Provide valves with bodies, bonnets, and covers constructed of cast steel conforming to ASTM A216/A216M.

2.1.9.1 Ball Valve

Valve shall be non-lubricated, double seated, ball type that conforms to API Spec 6D. Valve shall meet the fire test requirements of API Spec 6FA. Valve shall operate from fully open to fully closed with 90 degree rotation of the ball. Valve shall be capable of 2-way shutoff. Valve ball shall be constructed of stainless steel. Valves smaller than 2 inches shall have one piece bodies and shall have a minimum bore not less than 55 percent of the internal cross sectional area of a pipe of the same nominal diameter. Balls shall be provided with trunnion type support bearings for valves 14 inches and larger. Provide valves with worm gear operators, except valves 6 inches and smaller may be lever operated with a minimum 10 adjustable positions between fully opened and fully closed.

2.1.9.2 Ball Valve (Double Block and Bleed Type)

Valves shall be designed, manufactured, and tested to API Spec 6D. Double Block and Bleed Ball Valve (DBB) shall meet the fire test requirements of API Spec 6FA. Valves shall be trunnion-mounted with independent spring and hydraulically actuated, floating, single piston effect, self-relieving seat rings with bi-directional sealing. Ball shall be solid type with full through-conduit opening. Stem shall be anti-static, blow-out-proof design with o-ring seals and provided with an emergency sealant injection fitting. Valves shall be 3-piece, bolted body design equipped with body drain/bleed valve and vent fitting, and suitable for double block and bleed

service in the closed and open positions. Valves shall have nylon or teflon seat inserts, viton B body, stem, and seat o-rings, with stainless steel and graphite body gaskets and graphite secondary stem seals.

2.1.9.3 Plug Valve (Double Block and Bleed Type)

Provide non-lubricated, resilient, double seated, trunnion mounted type with a tapered lift plug capable of 2-way shutoff that conforms to API Spec 6D. Valve shall have electroplated nickel interiors. Valve plug shall be constructed of steel or ductile iron with electroplated nickel that is supported on upper and lower trunnions. Valve sealing slips shall be constructed of steel or ductile iron with Viton seals. Valve design shall permit sealing slips to be replaced from the bottom with the valve mounted in the piping. Minimum bore size shall be 65 percent of the internal cross sectional area of a pipe of the same nominal diameter, unless the manufacturer can show an equivalent or greater flow rate with a lower percent internal cross sectional area. Valves 6 inches and larger shall have removable lower and bonnet (upper) bushing. Valve shall have weatherproof, worm gear operators with mechanical position indicators. Indicator flag and shaft shall be made of steel. Provide valve body cavity relief and piping in accordance with STANDARD DESIGN AW78-24-27.

2.1.10 Welding Materials

Welding materials for carbon steel, stainless steel and aluminum shall comply with AWS WHB-4.8. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures. All field girth root pass welds shall be made with non-covered electrodes or welding wire. External welds on the pipe such as attaching pipe supports may be made with covered electrodes or welding wire. Electrodes, welding wire and fluxes are given in paragraph WELDING CONSUMABLES. Welding materials for aluminum and aluminum alloy shall comply with AWS D10.7/D10.7M.

2.1.10.1 Welding Consumables

AWS	Process	Alloy	Consumable	Use
			Note(1)	
AWS A5.1/A5.1M	SMAW	Low Carbon	E7018, E6010	Fill
AWS A5.4/A5.4M	SMAW	Stainless	E308L, E309L	Fill
AWS A5.3/A5.3M	SMAW	Aluminum		Fill
AWS A5.9/A5.9M	GTAW/GMAW	Stainless	ER308L,ER309L	Root and Fill
AWS A5.10/A5.10M	GTAW/GMAW	Aluminum	ER5356	Root and Fill Note (2)
AWS A5.18/A5.18M	GTAW/GMAW	Low Carbon	E70S-3,E70S-6	Root and Fill
AWS A5.22/A5.22M	GTAW	Stainless	E308LT1-1	GTAW-Root
AWS A5.32/A5.32M	GTAW/GMAW	All		Shielding Gas

AWS	Process	Alloy	Consumable	Use
			Note(1)	
Note(1): The consumable material designations shown are examples and are not intended to limit the selection of consumable materials. Note (2): Backing rings shall not be permitted.				

2.1.11 Dry Pack Mortar

Dry pack mortar shall be a combination of portland cement and sand passing a No. 16 sieve pursuant to ASTM C144. Mix with only enough water to hydrate the cement.

2.2 FABRICATION

Verify all dimensions with field measurements prior to fabrication. Fabricate structural steel for tank components in accordance with API Std 650 and AISC 325. All steel and metal work shall be well formed to shape and size, with sharp lines and angles, and true curves. Drilling and punching shall produce clean true lines and surfaces.

2.2.1 Steel Plates

2.2.1.1 Fillet Welded Patch Plates

Fabricate insert and patch plates shop rolled to match tank curvature. Edge of plates shall be smooth, free from laminations, scale, burrs, and slag. Prepare edges for welding in accordance with weld plan. Round corners of fillet welded repair plates to a minimum radius of 2 inches.

2.2.1.2 Insert and Replacement Plates

Fabricate insert plates and replacement plates in accordance with API Std 650, API Std 653, and as specified herein. Shop roll plates to match tank curvature. Edges of plates and edges of openings shall be uniform and smooth, free from scale, burrs, and slag accumulations, and prepared for welding in accordance with approved weld plan. Insert plates and replacement plates shall have 6 inch radius corners except when an entire shell plate is replaced to a horizontal joint.

2.2.2 Catwalk Repair

Fabricate welded steel angle minimum L2 x 4.7 extensions to the catwalk guardrails.

2.2.3 Sample Lines

Fabricate sample piping from 3/4 inch NPS welded carbon steel pipe. Isolate each sample line with a DBB plug valve in the lower tunnel. Do not use threaded components.

PART 3 EXECUTION

3.1 SAFETY

3.1.1 Control of Hazardous Energy

Prior to entry, provide proper lockout and tagout of the storage tank and appurtenances to completely isolate from sources of energy. Items to be isolated include nozzles, valves, pumps, and motor starters. Isolate tank and piping with physical means such as blind flanges compliant with ASME B16.5 or line blanks compliant with ASME B16.48 to prevent fuel transfer into the tank or piping. Do not use a valve as means of isolation. Provide in accordance with accepted Accident Prevention Plan, Section 01 35 26.05 20 GOVERNMENT SAFETY REQUIREMENTS FOR DESIGN BUILD and EM 385-1-1.

3.1.2 Tank Plate Access

Install robust means of access to all areas of the tank envelope for personnel, materials, and equipment. Provide access to the work, coordinated with Installation Safety, for the Contracting Officer representative while work is being performed. Provide bracing and supports to resist all construction loading conditions.

3.1.3 Preparation for Entry

Develop written procedures in accordance with API RP 575 for entry and re-entry into a storage tank. Ensure gas-generating, pyrophoric, or toxic residues have been removed. Test the interstice for hydrocarbons and purge as necessary. Be vigilant to accumulation of dry pyrophoric material. Do not start repairs until storage tank has been cleaned in accordance with Section 33 65 00 CLEANING PETROLEUM STORAGE TANKS, certified by the Marine Chemist to be safe for entry, and requirements of this Section and EM 385-1-1 have been met. Prepare for entry in a manner compliant with Section 01 35 26.05 20 GOVERNMENT SAFETY REQUIREMENTS FOR DESIGN BUILD.

3.1.4 Gas-Free Environment

Degass tank until requirements of Section 33 65 00 CLEANING PETROLEUM STORAGE TANKS, the accepted Accident Prevention Plan, API Std 2015, 29 CFR 1910.146, and the certified Marine Chemist are met. Obtain gas-free certification from the Marine Chemist. Maintain the gas-free environment. Maintain the Marine Chemist certificate on-site and available for review at all times.

3.1.5 Gas Test Hole

Pursuant to Marine Chemist requirements, install gas test holes in accordance with the shop drawing and hot work permit. Drill with a pneumatic tool using cooling lubricant. Purge the interstice with inert gas as-needed to remove hydrocarbon vapors and comply with API RP 2207. Record all gas test holes in the repair log.

3.2 WELDING OPERATIONS

Conduct welding operations in accordance with the weld plan and coordinated with the weld map. Limit welding personnel to welding procedures for which they are qualified.

3.2.1 Identification

Assign each welder or welding operator weld a unique identification number, letter, or symbol. Identify identification on the weld map. Ensure each identification is traceable to a welder and associated performance qualification record. Do not use fluorescent paint in tank.

3.2.2 Weld Joint Fit-Up

Provide fit-up and joint preparation so that root openings are in accordance with the weld plan. Parts that are to be joined by welding shall be fitted, aligned, and retained in position during the welding operation by the use of bars, jacks, clamps, or other mechanical fixtures. End welds shall be properly aligned prior to welding. Welded temporary attachments shall not be used except when it is impractical to use mechanical fixtures. When temporary attachments are used, they shall be the same material as the base metal, and shall be completely removed by grinding or thermal cutting after the welding operation is completed. If thermal cutting is used, the attachment shall be cut to not less than 1/4 inch from the member and the balance removed by grinding. After the temporary attachment has been removed, the area shall be examined visually and with other NDE means as determined necessary by the Welding Inspector.

3.2.3 Preheat and Interpass Temperatures

Preheat temperatures shall meet the requirements specified by API Std 650. However, in no case shall the preheat be below 50 degrees F for ferritic steel or austenitic stainless steel, or 32 degrees F for nonferrous alloys. The maximum interpass temperatures shall not exceed 300 degrees F for austenitic stainless steels, nickel alloys, and copper alloys; and 500 degrees F for carbon steels. Preheat techniques shall be such as to ensure that the full thickness of the weld joint preparation and/or adjacent base material, at least 3 inches in all directions, is at the specified temperature. Preheating by induction or resistance methods is preferred. When flame heating is used, only a neutral flame shall be employed. Oxy-fuel heating shall not be used on austenitic stainless steel; however, air-fuel heating is acceptable if controlled to insure that the surface temperature does not exceed 150 degrees F. Interpass temperatures shall be checked on the surface of the component within 1 inch of the weld groove and at the starting location of the next weld pass, and for a distance of 6 inches ahead of the weld, but not on the area to be welded.

3.2.4 Welding

Insert plates and shell replacement plates shall be butt-joint welded to the existing shell plate with complete penetration and complete fusion. Provide fit-up, heat input, and welding sequence to prevent distortion of the tank shell and insert plate. Provide temporary reinforcement of shell openings to prevent shell distortions. Coordinate shell openings and insert plate sizes to account for shrinkage during welding operations and to prevent peaking and banding in excess of API Std 653 criteria. Remove erection tabs by grinding the attaching welds when welding is complete. Gouging or tearing of the shell, insert plate, and replacement plate is not permitted.

a. Welding shall not be done when the ambient temperature is lower than 0 degrees F.

b. Welding is not permitted on surfaces that are wet, when rain is falling

on the surfaces to be welded, or during periods of high winds. The exception is when the welders and the work are properly protected.

c. Gases for purging and shielding shall be welding grade and shall have a dew point of minus 40 degrees F or lower.

d. Any welding process which requires the use of external gas shielding shall not be done in a draft or wind unless the weld area is protected by a shelter. This shelter shall be of material and shape appropriate to reduce wind velocity in the vicinity of the weld to a maximum of 5 mph.

e. Tack welds to be incorporated in the final welds shall have their ends tapered by grinding or welding technique. Tack welds that are cracked or defective shall be removed and the groove shall be retacked prior to welding. Temporary tack welds shall be removed, the surface ground smooth, and visually inspected. For low-alloy and hardenable high-alloy steels, the area shall be examined with the MT method.

f. Grinding of completed welds is to be performed only to the extent required for NDE and to provide weld reinforcement within the requirements of API Std 650. If the surface of the weld requires grinding, follow requirements in paragraph TANK REPAIR. Minimum weld external reinforcement shall be flush between external surfaces.

g. Permanently mark each weld with the identification symbol of the individual welding personnel.

h. Direct welded connection of carbon steel and stainless steel shall not be made.

3.2.4.1 Complete Joint Penetration Welds

Complete joint penetration welds shall be continuous, full size, complete fusion, and shall be made with a minimum of two passes. Weld profile shall be in accordance with AWS D1.1/D1.1M. All weld starts and stops shall merge with complete fusion to each other and to the base metal. Starts shall overlap the end of any previous weld by a minimum of 3/4 inches.

3.2.5 Postweld Heat Treatment

a. Postweld heat treatment shall be performed in accordance with ASME B31.3 and the welding plan. Temperatures for local postweld heat treatment shall be measured continuously by thermocouples in contact with the weldment.

b. Postweld heat treatment of low-alloy steels, when required, shall be performed immediately upon completion of welding and prior to the temperature of the weld falling below the preheat temperature. However, postweld heat treatment may be postponed after the completion of the weld, if, immediately after the weld is completed, it is maintained at a minimum temperature of 300 degrees F or the preheat temperature, whichever is greater, for 2 hours per inch of weld thickness.

3.3 TANK REPAIR

Coordinate the location of repair joints and existing joints. Make necessary adjustments to meet joint spacing requirements upon approval from

the designer of record. Repair all arc strikes in accordance with paragraph SHELL PLATE regardless of location.

3.3.1 Grinding

For tank shell areas which require grinding and after all grinding operations are complete, measure and record remaining plate thickness with UT. When grinding results in shell thickness less than 190 mils, repair the depression. When welding to restore thickness, provide complete fusion with the base metal and to each other on all weld passes. Inspect and test each weld pass and the completed repair. Correct defects in the repair that fail acceptance criteria. Use a patch plate to restore reduced thickness due to grinding if required by the designer of record.

3.3.2 Cutting

3.3.2.1 Preparation

Prior to cutting bottom, barrel, or dome shell plates:

a. Remove existing coating a minimum of 6 inches from each cutline.

b. Coordinate cutlines with repair plate dimensions.

c. Mark cutlines on the plate.

d. Provide temporary reinforcement around opening to prevent shell distortions.

e. Obtain approval from the Contracting Officer to cut the shell.

3.3.2.2 Marking

Prior to erection, identify members and repair plates with a painted mark. Connecting parts pre-assembled in the shop for installation in the field shall be match marked with paint. Do not use scratch or notch marks. Do not locate marks on areas to be welded. Do not use fluorescent paint in the tank.

3.3.2.3 Installation

Cut plates using a track guided cutting device in accordance with an approved procedure which produces a straight, neat, distortion-free cutline. Air carbon arc gouging and hand-held unguided cutting are not permitted. Prepare cut edges of the shell by grinding to remove all slag and burrs. Inspect cut edges for laminations. Accurately match insert plate to the tank shell and retain in position with erection tabs during welding operation. Tack welding of joints shall not remain in the finished joints. Misalignment in joints shall not exceed API Std 650 tolerances for misalignment in shell joints.

3.3.3 Substrate

At locations where tank shell material is removed for any reason, inspect, test, and report findings on the tank substrate material in accordance with Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS.

3.3.4 Plate Repair

Prior to performing repairs, remove existing coating to bare metal surface. Investigate the extents of arc strikes, gouges, pits, and attachment removal locations by careful grinding to completely remove the defect. Provide a smooth 4:1 transition with the surrounding plate. Examine ground area with MT to verify complete removal of the defect. Repeat testing-inspecting-grinding until defect is removed. Verify and repair deficient remaining plate thickness with requirement in paragraph GRINDING.

3.3.5 Gas Test Hole Repair

Repair gas test holes by grinding a groove and welding flush with the top of the base metal. Provide weld overlay a minimum of 1 inch past the groove weld in both horizontal and vertical directions. Provide a fillet-welded patch plate over the test hole repair.

3.3.6 Weld Repair

Remove the defect to sound metal. Use MT or PT to determine whether the entire defect has been removed. Preheat the site if conditions exist which would adversely affect the quality of the weld repair.

3.3.7 Nozzles, Flanges, and Manway

Provide washers under bolt head and nuts. Make up bolts using thread lubricant. Use calibrated torque wrench to tighten flange bolts to the value recommended by the gasket manufacturer. Follow tightening pattern as recommended by the gasket manufacturer.

3.3.8 Expansion Joint and Adjustment Plate Joint

Do not fuse the expansion joint stiffener plates in an amount more than the amount of existing plug weld.

3.3.9 Strain Gauge Pipe

Produce a mortar at a no slump consistency. A ball of mortar formed by hand should neither slump nor crumble due to lack of moisture. Uniformly pack the gauge pipe and carrier pipe annular space with mortar. Compact solidly by striking a hardwood dowel with a hammer. Overfill the hole slightly, then place the flat side of a piece of hardwood against the hole and strike it several times with a hammer. Cure for minimum 7 days prior to installation of fillet welded patch plate.

3.3.10 Drain Line

Repair the carrier pipe telltale drain to be functional. Install new drain line piping through the existing carrier pipe. Inspect, examine, and test in accordance with paragraph INSPECTION, EXAMINATION, AND TESTING. Support piping along tank bottom, through sleeve carrier pipe, and in lower tunnel. Distinguish the drain line with unique identification. Provide flanged isolation DBB plug valve.

Hydrotest the drain piping and the repaired carrier pipe to criteria in paragraph HYDROSTATIC TEST PARAMETERS. Test the drain line, carrier pipe telltale, and DBB plug valve for proper operation.

3.3.11 Sample Lines

Install sample piping system to the sample station. Inspect, examine, and test in accordance with paragraph INSPECTION, EXAMINATION, AND TESTING. Support piping on tower, along tank bottom, through sleeve carrier pipe, and in lower tunnel. Coat sample lines in accordance with Section 09 97 13.15. Distinguish the sample lines with unique identification. Install isolation DBB plug valves. Properly support all piping, valves, and sample station.

Provide intermediate pipe supports inside the containment pipe for the sample lines. Support shall consist of a steel plate with properly oriented holes through which the sample lines pass. Coat plate in accordance with Section 09 97 13.15. Support sample pipes at 10 feet on center inside containment pipe.

Hydrotest each piping segment to criteria in paragraph HYDROSTATIC TEST PARAMETERS. Test each sample line and valve for proper operation.

3.3.12 Interior Nozzle Flange

Replace existing interior nozzle flange on 32 inch product line with ASME B16.5 compliant flange.

3.3.13 Tank Appurtenances and Attachments

Remove existing shell attachments identified for removal by grinding the attaching welds. Repair areas failing acceptance criteria in accordance with paragraph SHELL PLATE using approved methods. Provide inspection of repair areas in accordance with paragraph NDE SCHEDULE. Repeat repair procedure until acceptance criteria are satisfied.

3.3.14 Tower, Bridge, and Catwalk

Install guides to restrain the tower columns at the upper dome. Replace missing or damaged fasteners or structural members. Weld repairs of bolts, studs, and nuts are not permitted. Use snug-tightening procedure pursuant to RCSC S348 to bring plies into firm contact. Pretension all high strength connections to a tension no less than specified in paragraph STRUCTURAL BOLT PRETENSION CRITERIA for ASTM A325 Bolts. Pretensioning shall be done by turn-of-nut method.

Install repairs in a manner which allows complete drainage and precludes crevice corrosion.

3.3.14.1 Structural Bolt Pretension Criteria

Fastener Diameter (inch)	Tension (kips)
5/8	19
3/4	28
7/8	39
1	51

Fastener Diameter (inch)	Tension (kips)
1-1/8	56
1-1/4	71
1-3/8	85
1-1/2	103

Tighten all other connections to the snug-tight condition. Perform snugging in a systematic manner starting at the most rigid part of the joint and working to the outside of the connection or the free edges. Use thin metal feeler gages, such as a machinists 6 inch metal rule, to ensure that gaps do not exist between the steel at the bolt holes. Install all bolts in a connection to a snug tight condition prior to pretensioning. Perform pretensioning in the same order as snug-tightening.

3.3.14.2 Bolts, Nuts, and Washers

Provide bolts, nuts and washers of the type specified. All nuts shall be equipped with washers. Where the use of high strength bolts is specified the materials, workmanship and installation shall conform to the applicable provisions of ASTM A325 and RCSC S348.

3.3.15 Coating System

Provide tank interior coating in accordance with Section 09 97 13.15 LOW VOC POLYSULFIDE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS. recoat surfaces affected by welding or repairs. Spot coat new patch plates.

3.3.16 Tank Calibration Table

After repairs are complete, coating has been installed, and the cure period has passed, calibrate tank in accordance with paragraph TANK CALIBRATION METHOD. Provide two hard copy laminated capacity tables stamped by a Professional Engineer, one in English units and one in SI units. Both tables shall show the volume of the fuel at all liquid levels in the tank from the gauge plate to the level of overflow. Include unit conversion notes on each table.

English unit table shall show the volume of product in gallons and barrels, and the corresponding level of product in 1/16 inch increments. SI unit table shall show the volume of product in liters and in cubic meters, and the corresponding level of product in 2.0 mm increments.

Volume calculations shall be made in the smaller units. Larger units may be obtained by rounding. The zero inch level shall be the level of the bottom of the gauge tube. Level below the bottom of the shell, including nozzle piping, shall be shown in negative units starting at the lowest point of the shell.

The level of the bottom of the shell, alarm set points, high level shut off valve actuation point, and the level of the overflows shall be identified on the calibration table (strapping chart). Tables shall not include tank volume above the level of overflows.

Provide on electronic media Electronic Tank Calibration Table compatible with the Electronic Automatic Tank Gauging System. Also provide tables identical to the master gauge table in format compatible with Microsoft Excel. Contact Contracting Officer for direction on required format.

3.3.16.1 Tank Calibration Method

Calibrate storage tank in accordance with the API Manual of Petroleum Measurement Standards (API MPMS) using the API MPMS 2.2D, Calibration of Upright Cylindrical Tanks Using the Internal Electro-Optical Distance Ranging Method.

3.4 VALVE REPAIR

Provide professional valve reconditioning services for the tank sl and isolation valves in accordance with API Std 598 and API RP 621. Provide services from an independent reconditioning facility with a documented and established quality assurance program which includes essential elements described in the ISO 9001 standard, and has written procedures compliant with API RP 621.

Disassemble, clean, and inspect all component for dimensional accuracy, surface condition, mating fit, and mechanical integrity. Use PT examination procedures in accordance with this Section and API RP 621. Provide supplementary PT examination of castings or forgings in accordance with Part 8 of ASME B16.34. Replace slips, soft seats, bonnet and cover fasteners, packing, gaskets, and grease fittings. Recondition valves to manufacturer standards and API RP 621. Pressure test each assembled valve compliant with API Std 598. Recoat exterior valve surfaces in accordance with Section 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES.

Provide Valve Reconditioning Report and DBB Valve Hydrotest Report for each valve in accordance with paragraph SUBMITTALS. Reinstall valves with new fasteners and gaskets. Commission valves back into service. Verify proper operation through the entire range. Ensure plug rotation towards open lifts the plug without wiping the seals and retracts the sealing slips so clearance is maintained between the slips and valve body. Verify full range of operation.

Adjust motor operator limit switches and torque settings to provide proper operation. Verify operation through its entire range and demonstrate to Government proper operation prior to requesting return to service.

3.4.1 Valve Op tion

Valve shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Rotation of the plug toward open shall lift the plug without wiping the seals and retract the sealing slips so that clearance is maintained between sealing slips and valve body. Rotation of the handwheel toward closed shall lower the plug after sealing slips are aligned with the valve body and force the sealing slips against the valve body for positive closure. When valve is closed, slips shall form a secondary fire-safe metal to metal seat on both sides of the resilient seal.

3.5 INSPECTION, EXAMINATION, AND TESTING

3.5.1 Inspection of Repairs

Provide inspector and engineering oversight during construction by the tank inspector of record and tank engineer. Provide an on-site in-progress presence by the API inspector of record to review and audit work . During the in-progress review, validate nondestructive testing results, evaluate weld quality, validate weld spacing meets API Std 653 criteria, and assess overall quality of repair work. Document results, prepare, and submit a brief report of Audit Inspection Findings.

During the construction phase, conduct review, inspection, and reporting by the tank inspector of record and the tank engineer. Provide:

a. Contemporaneous review of construction inspection, test, and examination records

b. Audit review of quality control reports, testimony photographs, repair log,and weld tracking log

c. In-progress review inspection at a minimum frequency of one review per every fifty repairs and no less than three on-site reviews

d. Prefinal inspection

e. Post-Repair Inspection Report

3.5.2 Weld Inspection

Welding personnel found making defective welds shall be removed from the work by the Quality Control Manager. The weld inspector(s) is considered a QC Specialist in accordance with paragraph WELD INSPECTION.

Perform weld inspection and NDE to detect surface and internal discontinuities in completed welds. Provide the services of independent NDE testing services for all nondestructive testing and inspection. Service organization shall meet requirements of paragraph QUALIFICATIONS and be approved by the Contracting Officer.

All tack welds, weld passes, and completed welds shall be visually inspected. In addition, perform magnetic particle examination on all root passes. Radiographic examination is required as indicated below. In addition to visual inspection, examine every weld with another method such as MT, PT, or RT.

When inspection and testing indicates disqualifying defects in a weld joint, the weld shall be repaired by a qualified welder in accordance with paragraph CORRECTION AND REWORK. The Contractor shall submit weld inspection and NDE field examination reports to the Contracting Officer.

Provide non-destructive examinations and inspections in accordance with paragraph NDE SCHEDULE.

3.5.2.1 Weld Inspector Duties

a. Verify the base materials and consumable welding materials conform to the specifications and that welding filler metals used are as specified for each base material.

b. Verify the welding equipment to be used for the work is appropriate for use with the welding procedure specification and has the capability to meet the applicable requirements of the welding procedure.

c. Verify only qualified and approved welding procedures are used.

d. Verify the edge preparation or joint geometry meet the requirements of the welding procedure and drawings.

e. Verify the specified filler metals are used and that filler metals are maintained in proper condition, per requirements, or as recommended by the manufacturer.

f. Verify procedure qualification and welding personnel qualifications are compliant with the weld plan.

g. Verify the technique and performance of each welding personnel is as specified.

h. Verify the work conforms to requirements of this Section, applicable standards, weld plan, design drawings, and manufacturer requirements.

i. Verify the work inspected is identified and documented in accordance with specified requirements.

j. Prepare and maintain clear and concise reports which record results of the inspections and examinations.

k. Verify the approved WPS pre-heat and post heat procedures are being used.

3.5.2.2 Visual Inspection

Inspect weld joints visually as follows:

a. Before welding: Compliance with requirements for joint preparation, alignment and fit-up, and cleanliness.

b. During welding: Cracks and conformance to the approved welding procedure.

c. After welding: Cracks, contour and finish, bead reinforcement, undercutting, overlap, weld slag on the interior of the pipe and size of welds. Visual examination of the interior of the pipe may be performed by any of the remote means allowed by ASME BPVC SEC V, visual inspection.

d. Enhance visual acuity with a magnifying lens of 5X power wherever required to discern indications otherwise not clear. Measure size and contour of welds with suitable gages.

3.5.3 NDE

The services of a qualified testing agency approved by the Contracting Officer shall be employed by the Contractor for testing of piping welds. Costs of testing, including retesting of repaired welds, shall be borne by the Contractor. Procedures for radiographic inspection shall be in accordance with NAVSEA T9074-AS-GIB-010/271 or ASTM E94. Weld ripples or

surface irregularities that might mask or be confused with the radiographic image of any objectionable defect shall be removed by grinding, or other suitable mechanical means. The weld surface shall be merged smoothly with the base metal surface.

Perform NDE as required by the weld inspector, this Section, ASME B31.3, and in accordance with written procedures. Procedures for radiographic, liquid penetrant, magnetic particle, or ultrasonic tests and methods shall conform to paragraph NDE PROCEDURE STANDARDS. Each approved procedure shall be demonstrated to the satisfaction of the Contracting Officer. In addition to the essential variables required in paragraph NDE PROCEDURE STANDARDS, the written procedures shall include the timing of the NDE in relation to the welding operations and safety precautions.

3.5.3.1 NDE Methods

a. Magnetic Particle: Perform magnetic particle inspection with the wet method and fluorescent particle material. The inspection zone shall include the weld and 1/2 inch of adjacent base material on each side of the weld.

b. Liquid Penetrant: Perform liquid penetrant exams prior to ultrasonic inspections on the same surfaces to avoid interference between the penetrant dye and residual couplant.

c. Vacuum Box: Apply a commercial bubble forming solution and subject the area of interest to a partial vacuum. Use a glass top vacuum box with hypalon or neoprene sealing gasket. Observe the solution film for bubble formation at an initial 2 psig differential pressure. Increase differential pressure to 5 psig. Hold vacuum for at least 20 seconds while continuing to observe the solution for bubbles. Minimum light intensity at the examination surface shall be 100 foot-candles.

d. PMI: Baseline the PMI instrument with reference spectra from the chemical analysis and pedigree report data. Analyze PMI results to determine whether variation exists with respect to base metal composition. Should variation in base metal composition be encountered, notify the Designer of Record and revise the weld plan for the localized condition.

3.5.3.2 NDE Frequency

Conduct NDE of all welding. The frequency of NDE shall be in accordance with paragraph NDE SCHEDULE. Provide VBT on all welding performed on the tank hydraulic boundary. Provide either PT or MT on all welding. Provide 100 percent radiographic testing for welds on underground piping.

All piping field welds shall be examined by radiographic methods to determine conformance with acceptance criteria in this Section. Provide random radiographic testing in accordance with ASME B31.3 for all aboveground piping on no less than twenty percent of welds. Random testing shall include RT of welds made by each welding operator or welder. Where RT is infeasible, perform PT of the root pass and the final surface of each joint. Employ the services of a qualified commercial or testing laboratory approved by the Contracting Officer for testing of piping welds.

If the testing reveals that any welds fail to meet minimum quality requirements, provide progressive sampling of welds in that same group in accordance with ASME B31.3. If all of the additional welds inspected meet

the quality requirements, the entire group of welds represented shall be accepted and the defective welds shall be repaired. If any of the additional welds inspected also fail to meet the quality requirements, that entire group of welds is rejected. The rejected welds shall be removed and rewelded, or the rejected welds shall be 100 percent inspected and all defective weld areas removed and rewelded.

3.5.3.3 NDE Schedule

Tank		NDE	
Location	Repair / Weld Type	Frequency	Method
Floor, lower dome, barrel, extension ring, upper dome	Full penetration butt joint weld	Each pass	VT
		Final pass	VT, MT, VBT
	Fillet weld	Each pass	VT
		Final pass	VT, MT, VBT
	Weld repair	Final pass	VT, UT, MT, VBT; Note 1
	Weld metal buildup	Final pass	UT, MT, VBT; Note 2
	Hole < 0.5 inch dia	Each pass	VT
		Final pass	VT, MT, VBT
	Cutline	Each	VT; Note 3
	Attachments		VT, MT, VBT
	Removal of attachments		VT, MT, VBT
	Insert plate	Each pass	VT
		Final pass	VT, MT, VBT
	Gouge, pit	Final pass	VT, MT, VBT

Tank		NDE	
	Adjacent to proposed weld	Barrel: Each row Upper Dome: Three Lower Dome: Five Tower/Catwalk: Three	PMI
Upper dome cover channels	Seal weld	Final pass	VBT
Nozzle	Butt joint weld	Root pass	PT
		Cover pass	PT
	Fillet weld		VT, MT
	Reinforcemen plate		VT, pneumatic, MT
Drain line	Butt weld	Root pass	RT or PT
		Cover pass	RT or PT
Sample line	Butt weld	Root pass	RT or PT
		Cover pass	RT or PT
Gas test hole	Groove weld	Final pass	VT, MT
	Weld overlay	Final pass	VT, VBT
Interior piping		Final pass	VT, MT
Tower, Bridge, Catwalk	Butt weld; Fillet weld	Final pass	VT, MT
Guardrail, intermediate rail, toe board	Butt weld; Fillet weld	Final pass	VT, MT
Base of tower legs - bottom plate joint		Prior to coating	SWUT
		After construction loads on tower removed, prior to	VBT

Note 1. Examination of a weld repair shall be repeated as required for the original weld.

Note 2. Examine the parent material with UT beneath the weld metal buildup to detect laminar defects after weld metal buildup.

Note 3. Examine the cutline for laminations, scale, burrs.

3.5.3.4 NDE Acceptance

NDE Acceptance shall be in accordance with API Std 653, API Std 650, ASME B31.3 Chapter VI, AWS D1.1/D1.1M,and this Section.

Interpretation of test results and limitations on imperfections in welds shall comply with the requirements of 100 percent radiography as defined in ASME B31.3. When NDE reveals imperfections of a type or magnitude not acceptable by the criteria specified in this Section, then progressive sampling for examination requirements in ASME B31.1 Chapter VI are triggered. Acceptance criteria are in the paragraph NDE ACCEPTANCE CRITERIA and notes.

3.5.3.5 NDE Acceptance Criteria

Method	Acceptance Criteria	Note
MFL	API Std 653 Annex G	
UT	ASME B31.3 Chapter VI	1
UT in lieu of RT	API Std 650 Annex U	1
VBT	API Std 650 8.6	
PT	ASME BPVC SEC VIII Appendix 8	2
MT	ASME BPVC SEC VIII Appendix 6	3
RT	API 650 8.1 / ASME B31.3	4
VT	AWS D1.1/D1.1M Table 6.1 / API Std 650 8.5	5
PMI	ASME BPVC SEC II-A	6

Note 1. Imperfections which produce a response amplitude greater than 20% of the reference level shall be investigated to the extent the operator can determine the shape, identity, and location of all such imperfections. Imperfections are unacceptable if the indications exceed the reference level amplitude and have lengths exceeding criteria in ASME B31.3 Chapter VI. In addition, indications characterized as cracks, lack of fusion, or incomplete penetration are unacceptable regardless of length.

Note 2. Indications with any dimension greater than 1/16 of an inch shall be considered relevant. All surfaces examined shall be free of ten or more rounded indications in any 6 square inches of surface, with the major dimension of this area not to exceed 6 inches, and the area taken in the most unfavorable location relative to the indications being evaluated.

Note 3. Indications with any dimension greater than 1/16 of an inch shall be considered relevant. All surfaces examined shall be free of ten or more rounded indications in any 6 square inches of surface, with the major dimension of this area not to exceed 6 inches, and the area taken in the most unfavorable location relative to the indications being evaluated.

Note 4. Acceptance criteria for all pipe and piping welds per ASME B31.3 Table 341.3.2 Severe Cyclic Conditions.

Note 5. Acceptance criteria per AWS D1.1/D1.1M except for surface porosity or exposed slag inclusion. Acceptance criteria for the extent of porosity or exposed slag inclusion is zero (no apparent imperfection) for welds less than or equal to 3/16 inch nominal thickness, and per API Std 650 8.5 for welds greater than 3/16 inch nominal thickness.

Note 6. Within the permitted variation in product analysis pursuant to ASME BPVC SEC II-A Table A.

3.5.4 Hydrostatic Testing

Isolate each test segment. Perform hydrostatic testing on nozzle, drain line, containment pipe, and sample line piping. Notify the Contracting Officer 14 calendar days in advance of testing. Hydrostatic testing shall not begin until permission is granted by the Contracting Officer. Only authorized personnel shall be permitted in the area during hydrostatic testing.

3.5.4.1 Instruments

Instruments shall be clean, in good working order, and within the calibration interval. Instruments without a calibration certificate shall not be used.

Calibrate all test instruments against a standard by a laboratory A2LA accredited to ISO 17025. Calibration shall have taken place no more than 6 months prior to the hydrostatic testing. Calibration certificates shall include the Model, Serial Number, date of certification and shall be signed by the testing company. Provide current Instrument Calibration Certificate for measurement instruments.

Provide indicating pressure test gauge connected directly to the segment and readily visible to the operator controlling pressure for the duration of the test. Analog type gauges shall be compliant with ASME B40.100 Grade 3A, accurate to ±0.25 percent full scale, graduated over a range not less than 1-1/2 times nor more than 4 times the test pressure, and incremented no greater than 0.5 psi.

Digital type pressure gauge shall be integral transducer type, compliant with ASME B40.100 Grade 3A, and accurate to ±0.25 percent full scale.

Provide digital contact thermometer incremented to 0.1 degree F or less. Memorialize pressure data with analog chart recorder. Transducers shall have a range not less than 1.5 times and not greater than 4 times the pressure being tested.

Use calibrated continuous recorders (dataloggers) with adequate storage capacity to record temperature and pressure data. Use the same time

interval for both measurements.

Measure the volume of test medium with a calibrated meter.

3.5.4.2 Procedure

For inaccessible piping, account for the volume of any test medium added or removed by measuring with a calibrated meter.

After filling has been completed, allow the test section to stabilize at twenty-five percent of the test pressure for twenty-four hours or until a temperature-time plot is asymptotic to ground temperature. Start pressure and temperature recorders prior to pressurization and run throughout the stabilization period to ensure proper stabilization has taken place before starting the hydrotest.

Test parameters are in paragraph HYDROSTATIC TEST PARAMETERS. Maintain segment at a steady test presure condition for a minimum of 15 minutes prior to initiation of examination for leakage. Examine piping, joints, and connections of accessible piping for leaks while maintaining test pressure. Leakage of temporary gaskets and seals, installed for the purpose of conducting the hydrostatic test and which will be replaced later, is permitted unless the leakage rate precludes maintenance of system test pressure for the required duration. Personnel performing the examination for leaks shall be qualified for visual examination. Extend the test interval as needed to ensure positive reconciliation of test data. Monitor temperature and pressure. Analyze consistent error, inconsistent error, the magnitude of any lost volume, and pressure versus temperature data trends.

Provide certification from the hydrostatic test examiner the piping segments are either pass or fail. Inconclusive results are not acceptable. Provide written Hydrostatic Test Record.

3.5.4.3 Hydrostatic Test Parameters

Piping Segment	Test Pressure	Test Duration (Hours)	Acceptance Criteria
Drain Line (accessible)	225 psig	4	No leak condition; no loss in gauge pressure
Drain Line (inaccessible)	162.5 psig	8	Inconsistent error less than 1 degree F
Sample Line	225 psig	4	No leak condition; no loss in gauge pressure
Telltale	225 psig	4	No leak condition; no loss in gauge pressure
Nozzle	162.5 psig	8	Inconsistent error less than 1 degree F
Carrier	162.5 psig	8	Inconsistent error less than 1 degree F

3.5.4.4 Test Water

Remove test water from segment upon completion of test. Apply for coverage under the State Department of Health Hawaii Administrative Rules 11-55 NPDES General Permit Authorizing Discharges of Hydrotesting Waters.

Sample, test, and characterize the water pursuant to the General Permit. Provide Test Water Characterization results to the Contracting Officer.

3.5.4.5 Disposal of Hydrostatic Test Water

If test results exceed allowable discharge limits in the General Permit, dispose of the water off installation in an appropriate manner. If discharge is allowed under the General Permit, provide a Test Water Disposal Plan to the contracting officer for approval. Water discharged on the surface shall be in a slow and controlled manner which will not result in erosion or migration outside the disposal area.

3.5.5 Inspection and Tests by the Government

The Government may perform inspection and supplemental nondestructive or destructive tests as deemed necessary. The cost of supplemental NDE will be borne by the Government. The correction and repair of defects and the re-examination of weld repairs shall be performed by the Contractor at no additional cost to the Government. Inspection and tests will be performed as required for visual inspection and NDE, except that destructive tests may be required also.

When destructive tests are ordered by the Contracting Officer and performed by the Contractor and the specimens or other supplemental examinations indicate that the materials and workmanship do not conform to the contract requirements, the cost of the tests, corrections, and repairs shall be borne by the Contractor. When the specimens or other supplemental examinations of destructive tests indicate that materials or workmanship do conform to the specification requirements, the cost of the tests and repairs will be borne by the Government.

When destructive tests are made, repairs shall be made by qualified welders or welding operators using welding procedures which will develop the full strength of the members cut. Welding shall be subject to inspection and tests in the mill, shop, and field. When materials or workmanship do not conform to the specification requirements, the work may be rejected at any time before final acceptance of the system containing the weldment.

In addition to inspection and test performed in compliance with this Section, the Contracting Officer may perform inspection and testing while work is in progress and at the completion of the work. The Contracting Officer shall have entry and access to all parts of the job while work is being performed. Provide access to the work surfaces necessary for Government inspection and testing.

3.6 CORRECTION AND REWORK

The tank shall be free from leaks and shall meet requirements of the Contract Documents. Correct defective and non-conforming work. Final determination of items requiring corrective action will be made by the Contracting Officer. When inspection and testing indicates defects in weld joints, repair the welds using a qualified welder.

3.6.1 Damage

Any damage, distortion, or deformation to any part of the tank or tank appurtenances resulting from the work shall be brought to the attention of the Contracting Officer within 24 hours of identification.

In the event faulty welding, or its removal for rewelding, damages the base metal so that in the judgment of the Contracting Officer its retention is not in conformance with the intent of the contract documents, remove and replace the damaged base metal.

Provide design and methods to repair the damage, distortion, or deformation to the Contracting Officer for approval. Conduct repair, inspection, and NDE examination of the repair in accordance with this Section.

3.6.2 Rework

Rework shall be in full compliance with requirements of this Section, API Std 650, and ASME B31.3. Repair defects in accordance with approved procedures. Defects discovered between weld passes shall be repaired before additional weld material is deposited. Wherever a defect is removed but repair by welding is not required, blend the affected area into the adjacent surface to eliminate sharp notches, crevices, or corners.

3.6.2.1 Defect Removal

Correct defective or unsound weld joints by removing and replacing the entire weld joint, or for the following defects corrections shall be made as follows:

a. Excessive Convexity and Overlap: Reduce by removal of excess metal

b. Excessive Concavity of Weld, Undersized Welds, Undercutting: Clean and deposit additional weld metal

c. Excessive Weld Porosity, Inclusions, Lack of Fusion, Incomplete Penetration: Remove defective portions and reweld.

d. Crack in Weld or Base Metal: Remove crack throughout its length, including sound weld metal for a distance of twice the thickness of the base metal or two inches, whichever is less, beyond each end of the crack, followed by the required rewelding. Complete removal shall be confirmed by magnetic particle inspection for carbon steel or liquid penetrant inspection for stainless steel.

3.6.2.2 Grinding

For areas which require grinding, and after all grinding operations are complete, measure and record remaining plate thickness with UT. Conform to requirements in paragraph TANK REPAIR.

3.6.3 Inspection and NDE of Rework

Inspect rework in accordance with all requirements of this Section. After a defect has been removed, re-examine the area with the nondestructive examination method with which it was discovered. Ensure the defect has been removed in accordance with the acceptance criteria in this Section. Any indication of a defect shall be regarded as a defect, unless re-evaluation by non-destructive methods after surface conditioning shows that no unacceptable defect is present. Do not repair an area by welding until the defect has been completely removed. Inspect and examine all reworked areas by repeating the original inspection and examination procedures.

3.7 DATA MANAGEMENT

Populate weld tracking and repair logs daily. Deploy data backup capability which will manage the security, integrity, and restorability risks of the repair database. Limit log edit rights to individuals in a position of trust with a specific need. Provide physical and administrative safeguards which will ensure data integrity

3.8 CLOSEOUT ACTIVITIES

The Tank Engineer and the Tank Inspector of record shall inspect, examine, and approve all repair and alteration work after repairs and alterations have been completed. The tank inspector of record is required to be on-site during additional occasions during construction as noted in Paragraph INSPECTION OF REPAIRS. Certify to the Contracting Officer compliance with this Section, requirements of API Std 653, and suitability for active fuel service. Provide a Post-Repair Inspection Report signed by the Inspector of Record, the independent tank inspector, and the Tank Engineer.

Provide new manway and valve flange gaskets along with new fasteners for all manway and flanged connections which were opened during the work.

3.8.1 Cleaning Interior Surfaces

After completion of the work, clean interior surfaces of the tank to remove all foreign matter such as dirt, debris, grease and oils. Provide interior surfaces free from sources of product contamination, fit for service in [diesel][aviation turbine] fuel storage, and to the satisfaction of the Contracting Officer.

3.8.2 Tower Leg Base Welds

After construction loads on the tower have been removed examine the tower leg to bottom plate welds with VBT.

3.8.3 Inspection During Tank Filling

After work is complete, remain onsite during tank filling. Verify all manways, flanges, gaskets, piping, valves, and other work are secure. Observe the tank being refilled until fuel level reaches full height. Assess for weeps and repair as necessary. Ensure full operation of MOVs.

3.8.4 Tank Return To Service

In order to return a storage tank to the operator fit for service, comply with NAVFAC Red Zone requirements in Section 01 45 00.05 20 DESIGN AND CONSTRUCTION QUALITY CONTROL, and requirements of NAVSUPGLSINST 10345.1. Minimum return to service requirements are:

a. Inspection Report

b. Tank Suitability for Service Statement

c. List of Identified Repairs

d. List of Recommended Repairs

e. List of Pending (Actual) Repairs

f. Calibration (Strapping) Charts

g. Signed statement which declares custody of the tank is returned to the Activity and items a through f above have been provided to the Contracting Officer

3.8.4.1 Completion Report

Upon completion of tank repairs and inspection of the repairs, provide a report. Submit Completion Report in accordance with Section 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES. Minimum report contents are:

a. Full tank inspection report pursuant to Section 33 56 17.00 20 INSPECTION OF FUEL STORAGE TANKS.

b. Repair report compiling all design, materials, repairs, quality control documentation, and logs made pursuant to this Section.

c. Quality Control Specialist reports to include independent tank inspector, coating inspector report, and tank engineer report.

d. Suitability for service statement.

e. Inspector of Record name, certification number, and date.

f. Storage Tank Engineer name, license number, and date.

g. Independent Tank Inspector name, certification number, and date.

h. Post-Repair Inspection Report

3.8.4.2 Suitability for Service Statement

This statement shall be a one page document. Include recommended service interval based on the corrosion rate and tank conditions. Specify the due date for the next inspection. Make clear whether the recommended interval is greater than DoD guidance.

-- End of Section --